

Rhizosphere Aeration & Porosity Handbook

The Plant Physiology Behind Root Hypoxia, Perched Water Tables, and Potting Mix Physics

1. Understanding the Perched Water Table (PWT)

Potting Parameter	Physical Mechanism	Practical Correction
Pot Depth vs. Diameter	The saturated zone (PWT) at the bottom is constant in height regardless of pot depth.	Use deeper pots for sensitive root systems to keep upper roots well above the saturation plane.
The 'Drainage Layer' Myth	Adding gravel to the bottom of pots *raises* the perched water table closer to roots.	Never put gravel or shards at the bottom. Use uniform, coarse soil throughout the pot.
Drainage Hole Mechanics	Water surface tension seals small single holes, preventing gravity drainage.	Ensure pots have multiple perimeter drain holes; elevate pots slightly above drip trays.

2. The High Air-Filled Porosity (AFP) Substrate Formula

Component	Ratio	Function in Rhizosphere
Coco Coir or Peat Moss	40%	Water retention and nutrient cation-exchange capacity (CEC).
Coarse Perlite or Pumice (1/4 in)	30%	Creates permanent, uncrushable macropores for continuous gas diffusion.
Orchid Bark / Horticultural Charcoal	30%	Prevents soil compaction, buffers pH, and encourages mycorrhizal colonization.